REMARKS/ARGUMENTS

[1]Remarks for Amendments Made to Claims 1 – 11:

[1.1] "[ ]" is removed around the number of the Claims so that all amended Claims begin with numerical numbers.

[1.2] In view of examiners detailed action item No. 2, Claim 1 has been amended as follows:

", said electronic and opto-electronic device comprising a first electrode layer; at least one organic semiconductor material layer; and a second electrode layer" has been replaced with <u>comprising the steps of: forming a first electrode layer using non-vacuum processing techniques; forming at least one organic semiconductor material layer using non-vacuum processing techniques; and forming a second electrode layer using non-vacuum processing techniques</u>" so that the amended Claim 1 reads as:

Claim 1 (currently amended) A non-vacuum process for the fabrication of an electronic and opto-electronic device based on organic semiconductors comprising the steps of:

- forming a first electrode layer using non-vacuum processing techniques;
- forming at least one organic semiconductor material layer using non-vacuum processing techniques; and
- forming a second electrode layer using non-vacuum processing techniques.

[1.3] Claim 2 has been canceled.

[1.4] Claim 3 has been amended as follows:

"methods for fabrication of" has been replaced with "<u>said non-vacuum processing techniques for forming</u>" and "of" has been replaced with "<u>including</u>" after "...selected from a group of solution processing techniques" so that the amended Claim 3 reads as:

Claim 3 (currently amended) A non-vacuum process as defined in Claim 1 wherein said non-vacuum processing techniques for forming said first electrode layer and said second electrode layer are independently selected from a group of electrochemical processing techniques including electroless deposition and electrodeposition. Said electroless deposition and electrodeposition may be carried out in either aqueous phase or organic phase.

[1.5] Claim 4 has been amended, in view of examiners detailed action item No. 2, as follows:

"methods for fabrication of" has been replaced with "<u>said non-vacuum processing techniques for forming</u>" and "of" has been replaced with "<u>including</u>". "ink-jet printing," has been deleted and "<u>, spray</u>" has been added between "thermal transfer printing" and "and screen printing." so that the amended Claim 4 reads as:

Claim 4 (currently amended) A non-vacuum process as defined in Claim 1 wherein said non-vacuum processing techniques for forming said first electrode layer and said second electrode layer are independently selected from a group of solution processing techniques including spin coating, thermal transfer printing, spray and screen printing.

[1.6] Claim 6 has been amended as follows:

"<u>first and second</u>" has been inserted between "said" and "electrode layers" so that the amended Claim 6 reads as:

Claim 6 (currently amended) A non-vacuum process as defined in Claim 1, wherein deposition of said first and second electrode layers are performed in a chamber containing an inert gas and a reduction agent.

[1.7] In view of examiners detailed action item No. 2, Claim 8 has been amended as follows:

"methods for application" has been replaced with "<u>said non-vacuum processing techniques for forming</u>" and "ink-jet printing," has been deleted. "of" has been replaced

with "including" and "and others" has been replaced with "spray and dip-coating" so that the amended Claim 8 reads as:

Claim 8 (currently amended) A non-vacuum process as defined in Claim 1 wherein said non-vacuum processing techniques for forming said organic semiconductor layer are selected from a group of solution processing techniques including spin coating, screen printing, thermal transfer printing, spray and dip-coating.

[1.8] Claim 9 has been canceled in view of examiners detailed action item No. 2.

[2]Arguments for Claims Rejected under 35 U.S.C 102 (b):

Please allow Claims 1, 4, 5, 8 and 11of the present application, which are rejected by the examiner under 35 U.S.C 102 (b) (refer to examiner's detailed action item No. 2) as being anticipated by Sturm (US Patent No. 6,087,196), based on the following rounds:

Claim 1:

Both Sturm (US Patent No. 6,087,196) and the present patent application teach **processes** for the fabrication of an organic electronic and opto-electronic device. The **structure** of such devices is **well-known knowledge** to everyone skilled in the art and is ***not*** a part of the invention in Sturm and in the present application. After the amendments to Claim 1 (see section [1.2]), the structures of the devices is no longer disclosed in Claim 1. Therefore, the device structure described by Sturm ***cannot*** be used to anticipate the **amended Claim 1** of the present application, in which a non-vacuum process for organic electronic and opto-electronic devices is disclosed.

Claim 4:

After the amendments (see section [1.5]), Claim 4 of the present invention discloses the formation of said first and second electrodes using a deposition methods selected from a group of solution deposition techniques including ***spin coating***, ***thermal transfer printing, spray*** *and* ***screen printing***, whereas in Sturm's invention, the non-vacuum method disclosed for the formation of the electrodes is an ***ink-jet printing***

method. Therefore, the two inventions disclose different solution techniques for the fabrication of the first and second electrode layers. As a result, **Claim 4** cannot be anticipated by Sturm.

Claim 5:

In Sturm's device, the **first electrode** (bottom electrode or ***anode***) is the **high work function** ITO film and the **second electrode** (top electrode or ***cathode***) is selected from a **low work function** material group such as: Mg-Ag alloy. In the present invention, the device takes an ***inverted*** structure so that the **first electrode** (bottom electrode) is the ***cathode*** made of a **low work function** material such as Mg, Ca and Li, while the **second electrode** (top electrode) is the ***anode*** made of a **high work function** material such as Au, Ag and ITO.

Moreover, in Sturm's device, the substrate used is commercially available ITO coated polyester sheets (column 5, lines1 – 2) and hence the first electrode (**anode**) is ***not*** a part of the Sturm fabrication process, whereas in the present application, the deposition of the first electrode (**cathode**) is ***a major step*** which is as important as the one for the second electrode in the fabrication process.

Therefore, based on the two distinctions, **Claim 5** of the present application cannot be anticipated by Sturm.

Claim 8:

After the amendments (see section [1.7]), Claim 8 of the present invention discloses the formation of the organic semiconductor layer using a methods selected from a group of solution deposition techniques including **spin coating**, **screen printing**, **thermal transfer printing**, **spray** and **dip-coating**, whereas in Sturm's patent, the non-vacuum method disclosed for the deposition of organic semiconductor layer is an ***ink-jet printing*** method. Therefore, it is obvious that the two inventions disclose different solution techniques for the fabrication of the organic semiconductor layer and **Claim 8** cannot be anticipated by Sturm.

Claim 11:

While both Sturm and present application teaches ***process*** for the formation of the light emitting diodes using non-vacuum methods, the fabrication process disclosed in the present invention uses **totally different** non-vacuum techniques (as compare to the **ink-jet printing** method disclosed by Sturm), which distinguishes itself from Sturm's process. Since the LED in Sturm and in the present application is made by means of ***different*** **processes/techniques**, Claim 11 of the present invention therefore is not anticipated by Sturm.

[3]Arguments for Claims Rejected under 35 U.S.C 103 (a):

[3.1] Ownership of the present application (see examiner's detailed action item No.5)

The inventors wish to state that all claims presented in the current patent application are invented jointly by the three inventors and are owned by Organic Vision Inc.

[3.2] please allow Claim 3 of the present application, which is rejected by the examiner under 35 U.S.C 103 (a) (refer to examiner's detailed action item No. 6) as being unpatentable over Sturm (US Patent No. 6,087,196) in view of Dimitrakopoulos (US Patent No. 6,334,662) and Dubin (US Patent No. 5,833,820), based on the following grounds:

(a) Dimitrakopoulos

Dimitrakopoulos teaches organic-inorganic hybrid TFTs and claims that gate electrodes of a **TFT** can be produced by numerous vacuum and non-vacuum methods including electrodeposition (Claim 6, column 10). However, he ***failed*** to present any description, either in the specification section or in his example (columns 8 – 10), of the electrodeposition process for the gate electrodes. The gate electrodes Dimitrakopoulos presented are either a **heavily doped Si wafer** (column 6, line 52 – 53) or an **electron**

beam evaporated bilayer of Ti/Pt (column 8 lines 30 – 32). Forthermore, the metals for gate electrodes in Dimitrakopoulos' TFT (as declared in Claim 5) are ***not*** **low work function** metals, but rather **high work function** metals like: Cr, Ti, Cu, Al, Mo, W, Ni, Au, Pt, Pd (see Claim 5 in column 10). For example, the gate electrode in the Figures 6A and 6B is **electron beam evaporated *Pt*** and ***Ti***.

Conventional electrodeposition process has been used commonly for thin metal coatings of high work function metals. However, it is not the case for low work function metals since these metals are highly prone to oxidation. In order to successfully deposit low work function metals and to maintain the quality of the metal films before a subsequent layer is applied, environmental factor is very crucial. In the present patent application, a chamber was designed to enclose the deposition system to create an oxygen/water vapor depleted environment for the low work function metal electrode deposition. On top of that, water rinsing, a routine step and a common practice after high working function metal depositions, is also prohibited for low work function metals after the deposition.

In conclusion, since Dimitrakopoulos does not teach an electrodeposition process suitable for both high and low work function metals, it would not have been obvious to one with skill in the art at the time of the invention to modify Sturm and deposit the low work function electrodes by an electrodeposition process for high work function metals such as the one declared by Dimitrakopoulos in Claim 6 in column 10.

(b) Dubin: a Process for Cu

Dubin's process is designed for **selective deposition of Cu**, one of the stable and high work function metals and therefore cannot be adopted for low work function metal depositions. Based on similar reasons presented in **(a)**, therefore, it would not have been obvious to one skilled in the art at the time of the invention to modify Sturm and deposit the low work function electrode by an electroplating process taught by Dubin in column 9, line 7.

(c) Conclusion

In conclusion, although Sturm teaches fabricating electrode layer by a **ink-jet printing** method, Dimitrakopoulos teaches electrodeposition of **high work function** metal gate layer for a TFT and Dubin teaches an **selective electrodeposition process** for high work function metal Cu, it would not have been obvious to one skilled in the art at the time of the invention to modify Sturm and to deposit both the low work function electrodes and the high work function electrodes by an electrodeposition process such as the one declared by Dimitrakopoulos and the one taught by Dubin. In view of the above-presented reasons, please allow Claim 3 of the present patent application.

[3.3] please allow Claims 6 and 7 of the present application, which is rejected by the examiner under 35 U.S.C 103 (a) (refer to examiner's detailed action item No. 7) as being unpatentable over Sturm (US Patent No. 6,087,196) in view of Dubin (US Patent No. 5,833,820) based on the following grounds:

(a) Different Objective for the Use of a Gas in Dubin and the Present Application

In Dubin's invention, apparatuses and methods for electroplating a metal (Cu) are disclosed. As described in Figures 1 and 2 and in column 5, lines 55 – 67 and column 6 lines 1 – 2, the objectives of their invention are an apparatus and a method for **selectively** electroplating metal (Cu) on a substrate while substantially **preventing electroplating metal on contact fingers** (Figure 1) and an apparatus and a method for electroplating metal on the front side of a substrate while substantially **preventing electrodeposition of metal on the backside and edges** of the substrate (Figure 2). In their invention, the role of the gas is to create a barrier, and which in turn prevents the electroplating solution from getting in contact with the contact fingers or the backside and edges of the substrate. Therefore, any gas as long as it is not affecting the plating process can be used for this purpose. In Dubin, ***air*** and ***nitrogen*** are used as the examples.

In the present application, the purpose of introducing a chamber (106) and filling and fluxing it with nitrogen (N_2) or argon (Ar) is to create an **oxygen/water vapor**

depleted environment so that a low work function metal film, such as magnesium (Mg), can be obtained to have minimum oxygen content. In the present application, the gas in the chamber is playing an active role (chemically) and is restricted to inert gas (N_2, Ar or a mixture of N_2 and Ar) and reduction agent (H_2).

(b) Different System Design in Dubin and the Present Application

Dubin discloses an electroplating system containing apparatus enclose **part of the substrate surface** (in Figure 1: the contact fingers; in Figure 2: the backside and the edges). By passing gas through the enclosed space created by the walls of the apparatus and the protected substrate surface, a gas barrier is formed on the protected substrate surface so that it is deprived of the chance to get in contact with the plating solution. For example, in Figure 1, during the deposition, a gas is flowed by means of gas line (18) into a shell (15) that encloses the contact finger (14) of the substrate (12) with a seed layer (13). The **flowing gas forms a barrier** which prevents the metal from being electroplated on the contact finger (14) (column 6 lines 24 – 41).

In the present application, the entire electrodeposition system, including the glass container (100) with the electrolyte (101), the anode (102) and the cathode substrate (103) is enclosed in a closed chamber (see Figure 1A of the present application) to **minimize the unwanted oxidation of the low work function thin film layer** to be deposited on the cathode substrate (103). The chamber has an inlet and an outlet for inert gas such as N_2, Ar or a mixture of them. When the flow of inert gas is initiated, the oxygen and water vapor within the chamber (106) will be pushed out of the chamber (106) so that the chance of oxidation of the low work function layer is reduced.

(c) Conclusions

In conclusion, the objectives of Dubin and the present application are completely different – **creating an air barrier to prevent deposition on unwanted substrate surface** vs. **oxygen depletion to prevent oxidation.** So are the system designs: **substrate surface enclosure** vs. **entire deposition unit enclosure**. The type of gas used

in Dubin is different from the present application as well: **any gas (including air and oxygen)** vs. **inert gas (exclude oxygen)**. The role of gas in our invention is of a **chemical nature** (to deplete oxygen and water vapor), while it is of a **physical nature** (to create an air barrier) in Dubin. Hence, it is reasonable to state that it would not have been obvious to one with ordinary skill in the art to modify Sturm and use the plating process by Dubin for depositing the low work function metals.

Based on the above-presented grounds, therefore, please allow Claims 6 and 7 of the present application.

[3.4] Speakman pertinence (see examiner's comment item #10)

Speakman (US 6,503,831) teaches a method of forming electronic device by a **drop on demand printing** method which is not part of the present invention and therefore cannot be used to anticipate the present invention.

The applicants hope that the above-described amendment is acceptable to you and respectfully request that a timely Notice of Allowance be issues in this case.

Respectfully submitted,

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